

CLAIMS

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5 1) Apparatus for in-vivo determination of bio chemical concentrations comprising an optical illumination source and a detector, said detector characterized as including at least one pressure transducer having a geometric shape which results in a point within a test tissue being more strongly coupled than immediately surrounding points.

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 2) Apparatus of claim 1, said detector is further characterized as a directional microphone whereby a predetermined space is favored over other spatial regions with respect to transducer response and performance.

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 3) Apparatus of claim 2, said detector being arranged to address a portion of flesh contain interstitial fluids in human tissue.

 4) Apparatus of claim 3, said bio chemical is a blood analyte.

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 5) Apparatus of claim 2, said detector is comprised of a plurality of transducers to form a multi-element detector array.

 6) Apparatus of claim 5, said plurality of transducers are arranged in an axially symmetric pattern.

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 7) Apparatus of claim 6, said arrangement of transducers substantially forms an annulus.

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 8) Apparatus of claim 6, said arrangement of transducers a plurality of annuli at least one concentric with another.

9) Apparatus of claim 8, said detector includes electronic means of effecting a phase delay of signals generated at either of said transducers.

10) Apparatus of claim 8) said arrangement of transducers includes an optical 5 port at the center.

11) Apparatus of claim 8, each ring is bifurcated into a plurality of wedge section sub-elements.

10 12) Apparatus of claim 11, detector includes electronic means of effecting a phase delay of signals generated at either of said sub-elements.

13) Methods of in-vivo determination of a bio chemical concentration by photoacoustic spectroscopy comprising the steps:

15 illuminating a tissue sample with middle infrared light;
receiving pressure waves emanating from illuminated tissue at a skin surface interface;
converting those pressure waves into electronic signals at a detector shaped such that energy emitted from a particular point is coupled to the transducer with a greater 20 efficiency than other nearby points.

14) Methods of claim 13, said converting pressure waves into electronic signals step is done at a plurality of spatially removed locations.

25 15) Methods of claim 14, conversion of pressure waves is done simultaneously, thereafter a phase delay created electronically and introduced into at least one of the electronic signals.

30 16) Methods of 14, said converting pressure waves is done at a plurality of areas distributed about a symmetry axis.

17) Methods of claim 16, conversion of pressure waves is done simultaneously, thereafter a phase delay created electronically and introduced into at least one of the electronic signals.

5 18) Methods of claim 13, said steps include an intermediate step after receiving pressure waves at a skin surface comprising: reflecting said pressure waves from a shaped reflection surface whereby said pressure waves further propagate to a focus and become concentrated thereat.